

PERFORMANCE SPECIFICATION

CAPACITORS, FIXED, ELECTROLYTIC (SOLID ELECTROLYTE), TANTALUM,  
ESTABLISHED RELIABILITY, GENERAL SPECIFICATION FOR

This amendment forms a part of MIL-PRF-39003H, dated 20 March 1992, and is approved for use by all Departments and Agencies of the Department of Defense.

PAGE 4

3.5.2.1, delete and substitute:

"3.5.2.1 Solder dip (retinning). The capacitor manufacturer or his approved category B distributor may solder dip/retin the leads of the capacitors supplied to this specification. The distributor's hot solder dip/retinning process shall be the same as the manufacturer's process, which shall be approved by the qualifying activity."

PAGE 5

Following 3.5.2.1.2, add:

"3.5.3 Tin plated finishes. Tin plating is prohibited as a final finish or an undercoat. Tin-lead (Sn-Pb) finishes are acceptable provided that the minimum lead content is three percent (see 6.8)."

3.7, title: Delete "(exponential only)".

PAGE 7

3.22, step 5 (+125°C), capacitance: Delete " $\pm 2$ " and substitute " $\pm 12$ ".

PAGE 9

3.29, last paragraph: Delete.

PAGE 15

4.4.4.1.2, line 4: Delete "be" and substitute "the".

4.5f, before "The", add: "(Exponential only)".

PAGE 19

TABLE VI, subgroup 2, after "Mechanical examination", add: "(physical dimensions only)".

TABLE VI, subgroup 2 (PPM) heading, add: "2".

TABLE VI, subgroup 3: Delete "Physical dimensions" test and its associated requirement paragraph number.

MIL-PRF-39003H  
AMENDMENT 4

PAGE 20

TABLE VII, subgroup 1, following "Thermal shock", add:

"Voltage aging (style CSR91 only) 3/ | 3.7 | 4.7.3 | 100% inspection "

TABLE VII, subgroup 1: Delete "Surge current (styles CSR21 and CSR33 only)" and its associated paragraph numbers.

TABLE VII, subgroup 1, after "Life (accelerated failure rate)", add: "1/".

TABLE VII, subgroup 1, following "Life (accelerated failure rate)", add:

"Surge current (styles CSR21 and CSR33 only) | 3.30 | 4.7.26 | "

TABLE VII, after subgroup 2 (PPM) heading, add: "1/".

TABLE VII, subgroup 2, after "Mechanical examination", add: "(physical dimensions only)".

TABLE VII, subgroup 3: Delete "Physical dimensions" and its associated paragraph numbers.

TABLE VII, subgroup 4 heading, add: "4/".

TABLE VII, bottom of table, add:

"4/ Sampling need only conform to the requirements of 4.6.1.1.1 exponential distribution inspection lot."

PAGE 21

TABLE VIII, delete and substitute:

" TABLE VIII. Sampling plan for ppm categories.

Lot size	Sample size	
	ppm-2	ppm-3
1 - 13	100 percent	100 percent
14 - 125	100 percent	13 units
126 - 150	125 units	13
151 - 280	125	20
281 - 500	125	29
501 - 1,200	125	34
1,201 - 3,200	125	42
3,201 - 10,000	192	50
10,001 - 35,000	294	60
35,001 - 150,000	294	74
150,001 - 500,000	345	90
500,001 - up	435	102

"

MIL-PRF-39003H  
AMENDMENT 4

4.6.1.2.3.1, line 2: Delete "13 samples" and substitute "13-piece sample".

4.6.1.2.3.1, line 3: Delete "sample lot" and substitute "sample".

PAGE 23

4.6.2.1.1.1, line 1: Delete "48" and substitute "72".

4.6.2.1.1.1, line 1: Delete "60" and substitute "84".

4.6.2.1.1.1, line 2: Delete "2 months" and substitute "3 months".

4.6.2.1.1.1, line 2: Delete "subgroups 1, 2, 3, and 5 of" and substitute "the subgroups listed in".

PAGE 24

TABLE X, delete and substitute:

" TABLE X. Group C inspection.

Inspection	Requirement paragraph	Test method paragraph	Number of samples	Number of failures allowed
<u>Subgroup 1</u>				
Shock (specified pulse) <u>1/</u>	3.14	4.7.10	—	—
Vibration, high frequency <u>1/</u>	3.15	4.7.11	—12	
Thermal shock and immersion <u>1/</u>	3.17	4.7.13	—	
<u>Subgroup 2 2/</u>				
Terminal strength	3.19	4.7.15	—	— 1 <u>3/</u>
Resistance to solvents	3.26	4.7.22	— 12	
Resistance to soldering heat	3.27	4.7.23		
Moisture resistance	3.20	4.7.16		
Sleeving	3.21	4.7.17	—	
<u>Subgroup 3</u>				
Life (at +125°C) (exponential only)	3.24.2.3	4.7.20.2.2	24	—
<u>Subgroup 4</u>				
Ripple current (CSR21 only)	3.28	4.7.24	12	1
<u>Subgroup 5 1/</u>				
Life (at +125°C)	3.24.2.3	4.7.20.2.3	24	1

1/ If the manufacturer can demonstrate that this test has been performed five consecutive times with zero failures, the frequency of this test, with the approval of the qualifying activity, can be performed on an annual basis. If the design, material, construction, or processing of the part is changed, or if there are any quality problems or failures, the qualifying activity may require resumption of the original test frequency.

2/ If the manufacturer can demonstrate that these tests have been performed five consecutive times with zero failures, these tests, with the approval of the qualifying activity, can be deleted. The manufacturer, however, shall perform these tests every 3 years after the deletion as part of long term design verification. If the design, material, construction, or processing of the part is changed, or if there are any quality problems, the qualifying activity may require resumption of the specified testing. Deletion of testing does not relieve the manufacturer from meeting the test requirements in case of dispute.

3/ This failure shall not be for the shock (specified pulse) or the vibration, high frequency test."

MIL-PRF-39003H  
AMENDMENT 4

4.6.2.1.1.2: Delete.

PAGE 25

4.7.3, title: Delete "(exponential only)".

4.7.4, add subparagraph c: " c. Magnification: Not applicable. "

PAGE 26

4.7.5c, delete last two sentences and substitute: "If failures exceed 10 percent, x-ray shall be performed in two planes on only those subsequent lots having the case size which caused the excess failure. The manufacturer may return to one-plane testing when three sequential lots of that case size meet the 10 percent failure rate."

PAGE 30

FIGURE, bottom of page, add: "FIGURE 4. Major defects-rejectable."

PAGE 31

4.7.10, delete subparagraphs c and d and substitute:

- "c. Measurements before test: DC leakage, capacitance, dissipation factor, and ESR (style CSR21 only) shall meet the requirements of 3.10, 3.11, 3.12, and 3.13, respectively.
- "d. Measurements and electrical loading during shock: During the test, observations shall be made to determine intermittent contact or arcing, or open- or short-circuiting. Detecting equipment shall be sufficiently sensitive to detect any interruption with a duration of 0.5 ms or greater. The dc rated voltage shall be applied to the capacitors during the test.
- "e. Examination after test: Capacitors shall be visually examined for evidence of arcing, breakdown, and mechanical damage."

PAGE 34

\* 4.7.20.1f, delete and substitute:

- "f. Measurements during exposure: DC leakage at the applicable high test temperature shall be made at the following intervals: 0 hours; 240 hours, +72 hours, -24 hours; 1,000 hours, +72 hours, -24 hours; and 2,000 hours, +96 hours, -0 hours. "

PAGE 35

4.7.20.2.2, title, add: "(exponential only)".

\* 4.7.20.2.2, delete and substitute:

"4.7.20.2.2 Extended life test (exponential only). Capacitors shall be tested as specified in 4.7.20.1, except that the duration of the test shall be 10,000 hours. DC leakage (at the applicable high test temperature) shall be made at the following intervals: 0 hours; 240 hours, +72 hours, -24 hours; 1,000 hours, +72 hours, -24 hours; 2,000 hours, +96 hours, -24 hours; and every 2,000 hours, +96 hours, -24 hours thereafter until 10,000 hours, +96 hours, -0 hours have elapsed. The final measurements shall be in accordance with 4.7.20.1g. "

MIL-PRF-39003H  
AMENDMENT 4

Following 4.7.20.2.2, add:

"4.7.20.2.3 Group C. Capacitors shall be tested as specified in 4.7.20.1."

\* 4.7.23b, delete and substitute:

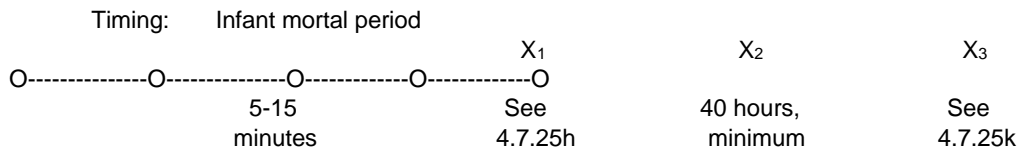
"b. Test condition: C, except that the time shall be 10 seconds,  $\pm$  1 second."

PAGE 36

4.7.25, delete and substitute:

" 4.7.25 Weibull FR level grading (see 3.29). Capacitors shall be tested in accordance with method 108 of MIL-STD-202. The following details and exceptions shall apply:

- a. Distance of the heating source from specimens, in inches: Not applicable.
- b. Method of mounting: Capacitors shall be mounted by their leads.
- c. Test temperature and tolerance: +85°C +4°C, -0°C.
- d. Operating conditions: Accelerated dc voltage, +4 percent, -0 percent, as applicable (see table XII), shall be applied gradually (not to exceed 5 minutes by a slow build-up of the voltage). Maximum nominal acceleration factor (see table XII), 20,000:1. Only the capacitors used in 4.7.25e must be fused. Voltage shall be applied continuously, except for failure count periods. The impedance of the voltage source, as seen from the terminals of each capacitor, shall not exceed 1 ohm. An electronic power supply capable of supplying at least 5 amperes when a capacitor is shorted shall be used. A 1 ampere to 2 ampere fuse shall be connected in series with each capacitor. Slow-blow fuses shall not be used. If separate equipment is used for testing the sample and the rest of the lot, the equipment shall be cross calibrated for temperature, voltage, and time to ensure equivalent test conditions.
- e. Minimum sample size for monitoring at beginning of test prior to infant mortal period: 300 pieces, or 100 percent, whichever is less. If the sample size is less than 100 percent, the remainder shall be subjected to the same accelerated dc voltage for the same amount of time.
- f. Duration of test: 40 hours minimum. The manufacturer shall record the test start and stop times for each lot tested.



- g. Failure definition: A failure is defined as a blown fuse or equivalent.

MIL-PRF-39003H  
AMENDMENT 4

- h. Failure count during test: The lot size (see 4.6.1.1.3) to be graded is established after removal of gross defectives (infant mortality) (5-15 minutes). The first failure count shall be performed at 2 hours,  $\pm 0.3$  hour after the test was started. If there are no failures at time  $X_1$ , the manufacturer may use one of the following options:
- (1) Complete a minimum of 40 hours and compute the failure rate from MIL-STD-690, table II, FRSP-90, based on the number of failures at time  $X_2$ , or;
  - (2) Extend time  $X_1$  from 2 hours to a maximum of 10 hours. A failure cannot be assumed. If there are still no failures, option (1) shall be used, or;
  - (3) Make one restart at a higher voltage (if applicable) to induce a failure at time  $X_1$ . The manufacturer shall assume no previous hours. The restart voltage and time shall be recorded. If there are still no failures, option (1) shall be used. If the sample size is less than 100 percent, the remainder of the lot must be subjected to the final determined restart time and voltage. The number of blown fuses and the time under test shall be recorded to within "0.1 hour. Calculate the fraction failed,  $p_1$ , at time  $x_1$  (see equation 4 (6.6.2)).
- i. Failure count after test: A failure count shall be performed after 40 hours minimum after the test was started. The number of blown fuses and the time under test shall be recorded to within  $\pm 0.1$  hour. Calculate the cumulative fraction failed,  $p_2$ , at time,  $x_2$  (see equation 4 (6.6.2)). If there are no failures at time  $X_2$ , the manufacturer may use one of the following options:
- (1) Assume one failure and calculate the cumulative fraction failed,  $p_2$ , at time  $X_2$  (see equation 4 (6.6.2)), or;
  - (2) Compute the failure rate from MIL-STD-690, table II FRSP-90, based on the accelerated part hours generated (see 6.6.2, example C), or;
  - (3) Continue testing. The start and stop times shall be recorded. If there are still no failures, option (2) may be used.
- j. Lot failure rate: Determine  $Z(t)$  from equation 3 (6.6.1). If the desired failure rate has been achieved, the lot may be removed from test.
- k. Continuation grading: If the desired failure rate has not been reached, the lot may be continued on test. The time to reach the failure rate goal may be estimated from equation 5 (see 6.6.2). If the time calculated to reach the goal failure rate is excessive, the lot may be discarded in favor of a new lot. If the lot is continued on test, a new failure rate shall be performed after the extended test. Calculate the cumulative fraction failed,  $p_3$ , at time  $X_3$  (see equation 4 (6.6.2)). Determine if the failure rate has been achieved from 4.7.25j.
- l. Measurements after exposure: Capacitors shall be removed from the test, stabilized at room ambient conditions (see 4.3.1) and the dc leakage, capacitance, dissipation factor, and ESR (style CSR21 only) shall be measured as specified in 4.7.6, 4.7.7, 4.7.8, and 4.7.9, respectively. "

MIL-PRF-39003H  
AMENDMENT 4

PAGE 43

6.8, delete and substitute:

"6.8 Tin plated finishes. Tin plating is prohibited (see 3.5.3) because it may result in tin whisker growth. Tin whisker growth could adversely affect the operation of electronic equipment systems. For additional information, see ASTM B 545 (Standard Specification for Electrodeposited Coating of Tin).

"6.9 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes. "

The margins of this amendment are marked with an asterisk to indicate where changes (additions, modifications, corrections, deletions) from the previous amendment were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous amendment.

Custodians:

Army - CR  
Navy - EC  
Air Force - 85

Preparing activity:

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